

Trends in Engineering Student Admission: Preliminary Study of Politeknik Tuanku Sultanah Bahiyah

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Abstract

Engineering programs are the most popular types for students who seek to become technicians or engineers. Furthermore, the Malaysian government is focused on technical and vocational education and training (TVET). This study investigates the patterns of enrollment for mechanical engineering students at Politeknik Tuanku Sultanah Bahiyah. Data extracted from the Student Affairs Department at Politeknik Tuanku Sultanah Bahiyah for the years 2015 through 2017. The study's findings show that enrollment for mechanical engineering programs decreased for both the June and December sessions (but particularly for the December session) from 2015 through 2017. One reason for this is that enrollment among students seeking a mechatronic diploma decreased by 50% in 2017.

Keywords: Engineering student, Higher education institutions, Industrial jobs

1.0 Introduction

Sijil Pelajaran Malaysia (SPM) is a certificate program in which students at higher education institutions gain knowledge and skills before joining the industrial workforce. All students need to align their results with their job interests as they apply to programs offered by higher education institutions. Most such institutions offer both diploma and degree programs for SPM candidates. However, technical institutions also provide skills certificates and diplomas in order to produce workers with technical skills.

A very important issue for students to consider is employability. Engineering programs are the most popular types for students who seek to become technicians or engineers. Furthermore, the Malaysian government is focused on technical and vocational education and training (TVET). Politeknik Malaysia is TVET institution that offers skill training to student who are seeking to join the industrial workforce. The demand for engineering programs is higher when those programs can produce semiskilled workers.

Several higher education institutions are TVET providers, including Institut Kemahiran Belia Negara, Institut Kemahiran Mara, Pusat Latihan Teknologi Tinggi, University of Kuala Lumpur and Politeknik Malaysia. Each of these institutions tends to focus on an area of strength so as to attract students. Thus, the distribution of enrollment could be influenced by the fact that many institutions offered TVET.

Malaysia is rapidly developing, especially in terms of construction and infrastructure; this has increased the demand for engineers. Statistics from the National Council for Scientific Research and Development indicate that Malaysia will need 493,830 engineers by 2020 (Christina, 2016). However, despite the declining rate of engineering students worldwide, studies on students' interest in engineering are still limited—especially in Malaysia (Nurul Asyikin & Suhaila, 2018). Furthermore, the Malaysia Ministry of Education (2013) estimated that, based on the current trend, Malaysia will fall short of the 236,000 technical personnel that it needs to achieve the Ministry of Science, Technology and Innovation's 2020 Mission. This is due steadily declining interest in engineering programs—not only in Malaysia but worldwide—over the last five to ten years. This trend is especially significant for universities in Hong Kong, South Africa and India, which have recorded a steady decline of 100,000 engineering students over the past two years.

The objective of this paper is to examine the trends in engineering enrollment from 2015 through 2017 at Politeknik Tuanku Sultanah Bahiyah, based on data extracted from its Student Affairs Department. This study's finding provides evidence of increasing engineering enrollment in the June intake between 2015 and 2016 but decreasing enrollment between 2016 and 2017. Furthermore, enrollment decreased in each year for the December intake. The study's findings also show that enrollment for the Mechanical Engineering Department's programs decreased in both the June and December sessions—but particularly for the December session—from 2015 through 2017. Notably, the enrollment for students seeking a mechatronic diploma decreased in 2017 by close to 50%.

The remaining sections are organized as follows: Section 2 discuss the ideas from past studies on relevant topics. The study's research design and methodology are described in Section 3; the details of the final sample and the variables are also discussed in Section 3. The results and discussion are presented in Section 4. Finally, Section 5 sets out the study's conclusions and limitations, as well as some suggestions for further research.

2.0 Literature Review

Demand for engineering is associated with government policies that are intended to make Malaysia into a developed country. Malaysia needs more scientist and engineers to participate in the construction, shipping, petroleum, automation and health sectors. These sectors are the backbone of the country

and essential to its success and ability to earn respect from other countries. Therefore, the government requires that secondary schools emphasize science, technology, engineering and mathematics. Hamdan (2012) asserts that an effective action plan must be implemented to increase the number of students to take up science not only at the university level but also at the school level.

Researchers have addressed the relationship between enrollment in engineering programs and careers as engineers (Mohamed Ariffin, 2007; Holtzapple & Reece, 2010). For example, mechanical engineering courses prepare students to become mechanical engineers and marine engineers (Mohamed Ariffin, 2007). Furthermore, civil engineering provides training in areas such as transportation, structural, civil and building services, which provide students with the opportunity to join the road-building and construction industries (Holtzapple & Reece, 2010)

Schools are responsible for creating interest among students in subjects such as science and mathematics so that those students can become engineers, doctors and so on. According to Mohd Amin and Ripin (2010), higher education institutions play an important role in raising awareness regarding career readiness among students so that those students will explore their career options. Students who are less interested in studying science may be less likely to earn admission to higher education institutions that focus on engineering. According to Abu Talib and Tan, (2009) students who worry about their career readiness are less ready than other students to make decisions regarding their career paths. In addition, students with poor science results may have fewer opportunities to attend engineering programs—or may even be disqualified. Students' results in science and mathematics are related to their interest in those topics. However, students who do not have career prospects still have difficulty making decisions about which field to study.

Nurul Asyikin and Suhaila (2018) focused on interest in engineering among students from Maktab Rendah Sains Mara Bentong, the first technical junior college in Malaysia. This institution introduces modules on technical learning, robotics and engineering science to students as young as 13 years old. The students choose a technical major when they are 16 years old (or later, when they attend university). The largest proportion of surveyed students, 38.98%, were interested in electrical and electronics engineering (EE); this was followed by mechanical engineering (ME) at 25.42%, civil engineering (CE) at 17.8% and electrical power (EP) at 5.93%. The remaining 11.86% expressed no preference or were still undecided. Even though this is a technical school, over 11% of its students experience indecision regarding admission to engineering programs. Previous study shows that the declining interest in engineering programs may influence student enrolment into polytechnics.

What is the best way to maintain students' interest in subjects such as science and mathematics? Traditionally, these subjects have been known as tough subjects, and they have become a priority for students who hope to gain

admission to engineering programs. When students have poor results in both of these subjects, they have fewer possibilities as far as engineering programs. Therefore, it is very important to foster interest in science and mathematics in students so as to increase their motivation to study hard and get better grades and test scores in these subjects. Thus, when students who are interested in these subjects and who have good SPM results, they have more options for admission to engineering programs.

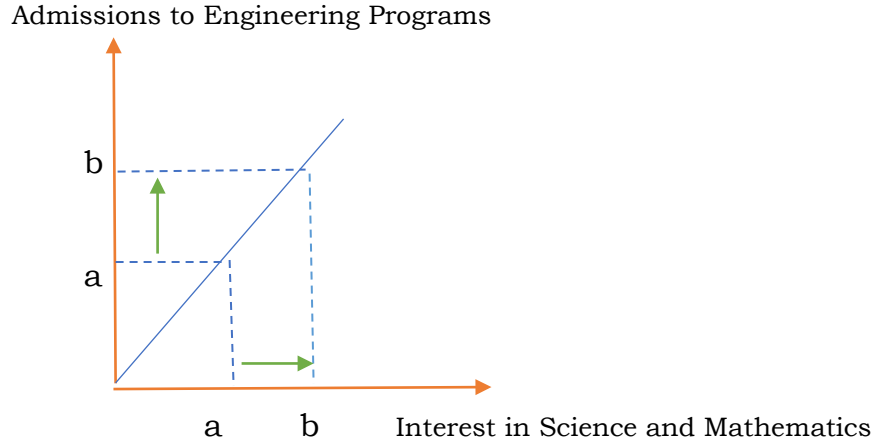


Figure 1: Relationship between Interest in Science and Mathematics and Admission to Engineering Programs

Why are students becoming less interested in engaging in further study in engineering at higher education institutions, at either the diploma or degree level? Is this about a decline in interest in engineering, or do members of the young generations prefer not to take difficult courses? Perhaps they believe that other fields will lead to better future careers? According to this study's results, parents, schools, private organizations, higher education institutions and the government should all take responsibility for ensuring that students have an interest in science and mathematics.

In the Malaysian context, students can choose their future area of study as early as the upper secondary level. The government prefers that more than 60% of upper secondary students focus on science. However, in 2014, only 21% of upper secondary students chose science as their area of study. This shows the trend in which members of Generation Y are less interested in studying science than members of previous generations; this will cause a shortage of science graduates in coming years, especially in engineering (Nurul Asyikin & Suhaila, 2018).

Students acknowledge the benefits of science, technology, engineering, and mathematics, but these subjects do not interest them. Why should they take difficult subjects so that they can then work in stressful jobs, even if these jobs have high salaries? Engineering, medicine and science offer good careers, with high salaries and high social status, but they are still unattractive for

many students. This is because, to become an engineer (for example), an individual need to have significant skills and knowledge in technical areas, as well as strong mental and physical abilities (Kamro, 2012).

Therefore, many students prefer to take less difficult courses that lead to less stressful careers with lower (but still good) salaries. This is a very interesting aspect to explore. This situation could lead to high demand among potential students of higher education institutions. The Internet, television and other people influence students' views of success in their careers. For example, there is high demand related to careers as chefs; musicians; actors; and athletes in football, badminton and other sports that provide good salaries. According to Mohd Amin and Ripin (2010), it is important for higher education institutions to use their authority to create awareness about career readiness among their students.

3.0 Methodology

This study uses secondary data extracted from the Student Affairs Department at Politeknik Tuanku Sultanah Bahiyah for the years 2015 through 2017. The sample does not include data from the Commerce Department because that department has different criteria for admission. All engineering students are required to have credits in mathematics. The admissions committee for the engineering program considers initial qualifications for all courses. For the Commerce Department, the programs in areas such as marketing and business do not require mathematics only the Accounting Program requires math credits.

The data covers two sessions: June and December. The enrollment is higher in June than in December because the SPM was announced in March. Therefore, there was particularly high competition (based on merit) in June among the students who sought to study at Politeknik Malaysia. The study uses descriptive analysis methods such as means. The results are presented via tables and graphs for easy understanding and interpretation.

4.0 Results and discussion

Table 1 shows the enrollment values for the Civil, Electrical, and Mechanical Engineering Departments. The data shows a sharp contrast in enrollment between the June and December intakes for all departments. For instance, the Civil Engineering Department's enrollment was 239 students in June but only 192 students in December. This scenario indicates that only meritorious students were offered admission. Factors in the gap between June and December include the fact that potential Politeknik Malaysia students can choose other institutions and are often influenced by their parents.

Table 1: Enrollment by Department and Intake Period, 2015–2017

	Civil Engineering	Electrical Engineering	Mechanical Engineering
June	239	301	234
December	192	185	111

Figure 2 presents the enrollment for each of the engineering departments for the June intakes from 2015 through 2017. For the June intake, the enrollment in the Mechanical and Electrical Engineering Departments increased between 2015 and 2016 but slightly decreased between 2016 and 2017. The Civil Engineering Department, however, had increased enrollment each year. The Electrical Engineering Department averaged 301 June admissions per year, ranging from 286 students in 2015 to 326 students in 2016. The Mechanical Engineering Department averaged 234 students, ranging from 198 in 2017 to 268 in 2016. Finally, the Civil Engineering Department averaged 239 students, ranging from 204 in 2015 to 262 in 2017. The data indicate that diploma-level engineering programs still have demand from industries that seek technicians. In addition, parents and teachers are encouraging students to study engineering and to become technicians or engineers.

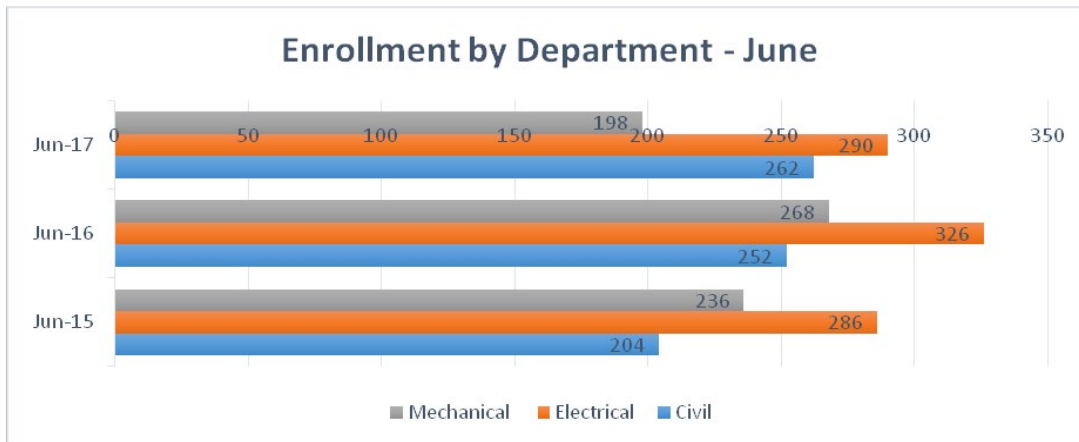


Figure 2: Enrollment by Department (June Intake)

Figure 3 indicates that all engineering departments shows increased enrollment of between 13% and 24% from 2015 to 2016. However, the enrollment for all engineering departments decreased by 4% to 26% from 2016 to 2017. The Mechanical Engineering Department had the largest decrease; the demand for the Mechanical Program is lower, so that department is less able than the others to attract potential students. The Electrical Engineering Department shows the same pattern as the Mechanical Engineering

Department, but it had a less severe decrease of 11% in 2017. By contrast, the Civil Engineering Department experienced only a slight decrease in 2017.

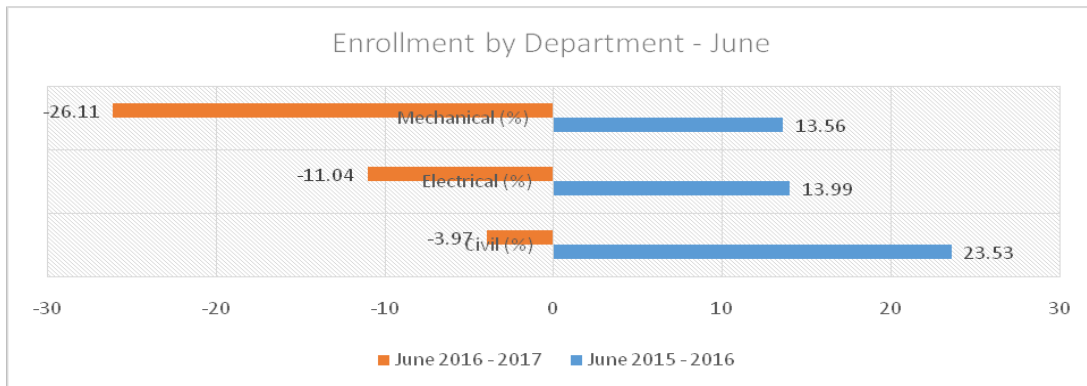


Figure 3: Yearly Change in Enrollment by Department (June Intake)

Figure 4 presents the trends in enrollment from 2015 through 2017 for the December intake. Between 2015 and 2016, there was decreased enrollment for the Civil and Electrical Engineering Departments but increased enrollment for the Mechanical Engineering Department. However, no department had increased enrollment in 2017. There was a serious drop in enrollment from 2016 to 2017 for the Mechanical Engineering Department; although the Civil Engineering Department saw a continued decrease in enrollment from 2015 through 2017, the Electrical Engineering Department had the same enrollment in 2016 and 2017.

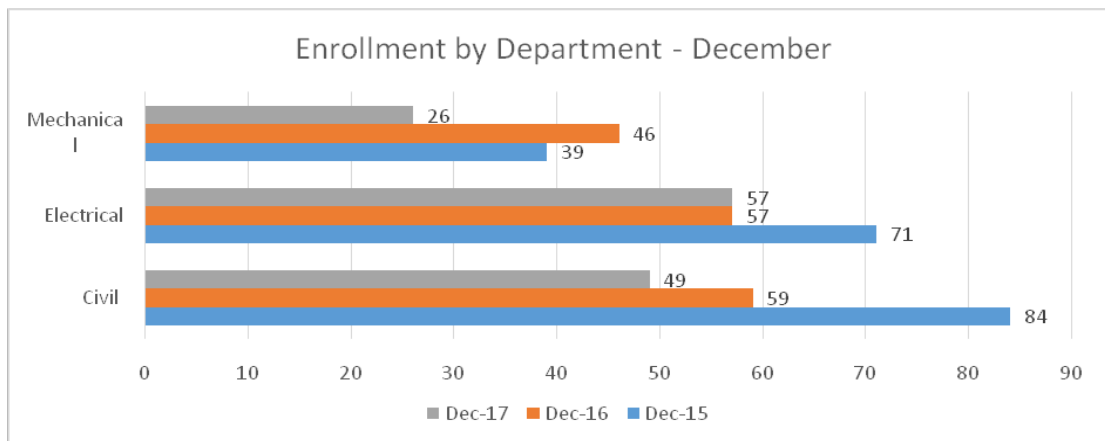


Figure 4: Enrollment by Department (December Intake), 2015–2017

Figure 5 presents the enrollment trends from 2015 through 2017. This shows that the December enrollment in the engineering programs continued to decrease between 2016 and 2017, especially the Mechanical Engineering Department, which declined by 43.48%. This decline is a serious matter. If this

continues, it may affect staffing and salaries, as it may cause the ratio between academic staff members and students to become misaligned.

Students who had unsuccessful applications for the June session had time to reapply for the December session. However, this situation may have caused parents to worry that their children would lose interest in their studies. Therefore, they may have believed that attending another technical institution was best choice, which in turn, may have affected the admissions to this institution's engineering programs. The parent also may not have wanted to wait until the December intake because they wanted to ensure their children did not waste time on smoking, and drugs.

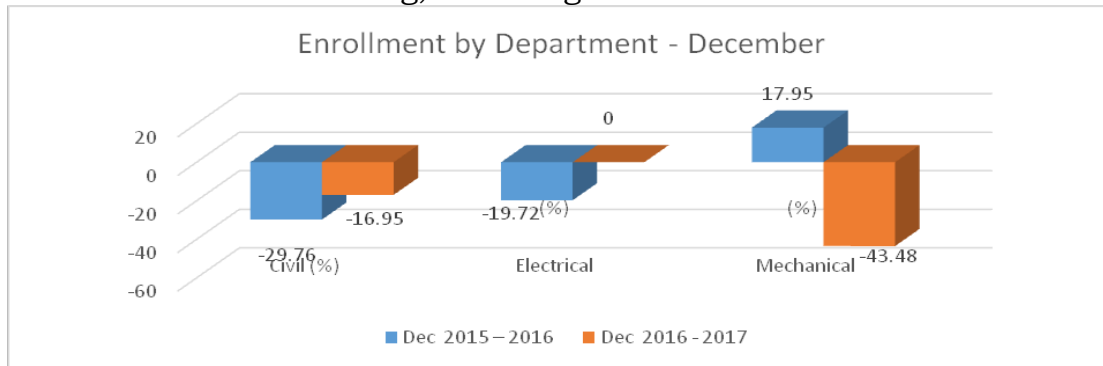


Figure 5: Yearly Change in Enrollment by Department

Table 2 present a correlation matrix between the department for June and December intake from 2015 until 2017. There are no correlations between departments for June and December intake. Initial results indicate that June or December intake having a similar requirement for the Civil, Electrical and Mechanical Department.

Table 2: Correlation Matrix

	JUN_JKA	DEC_JKA	JUN_JKE	DEC_JKE	JUN_JKM	DEC_JKM	JUN_JP	DEC_JP
JUN_JKA	1	-0.993	0.437	-0.987	-0.210	-0.327	0.600	-0.889
DEC_JKA		1	-0.327	0.961	0.324	0.437	-0.691	-0.828
JUN_JKE			1	-0.577	0.788	0.707	-0.457	-0.801
DEC_JKE				1	0.049	0.171	-0.463	0.951
JUN_JKM					1	0.993	-0.908	-0.261
DEC_JKM						1	-0.952	-0.142
JUN_JP							1	-0.167
DEC_JP								1

Notes: JUN_JKA is June intake for Civil Department. DEC_JKA is December intake for Civil Department. JUN_JKE is June intake for Electric Department. DEC_JKE is December intake for Electric Department. JUN_JKM is June intake for Mechanical Department. DEC_JKM is December intake for Mechanical Department. JUN_JP is June intake for Commerce Department. DEC_JP is December intake for Commerce Department.

Figure 6 presents the trends in enrollment for each program in the Mechanical Engineering Department between June 2015 and June 2017. The enrollment for the Mechanical Program increased from 106 in June 2015 to 130 in June 2016. However, it experienced a slight decrease from June 2016 to June 2017. The average enrollment for the Mechanical Program was over 100 students for the June intake. The demand for the Manufacturing Program was lower than those for the other programs in the Mechanical Engineering Department. Enrollment continued to decrease from June 2015 through June 2017, but the enrollment figures for June 2016 and June 2017 were similar, with around 30 students each. The Mechatronic Program shows extreme changes between years. The June 2016 enrollment was the best for the Mechatronic Program with more than 100 admitted students. However, the June 2017 enrollment decreased significantly, with only 51 students admitted for that session.

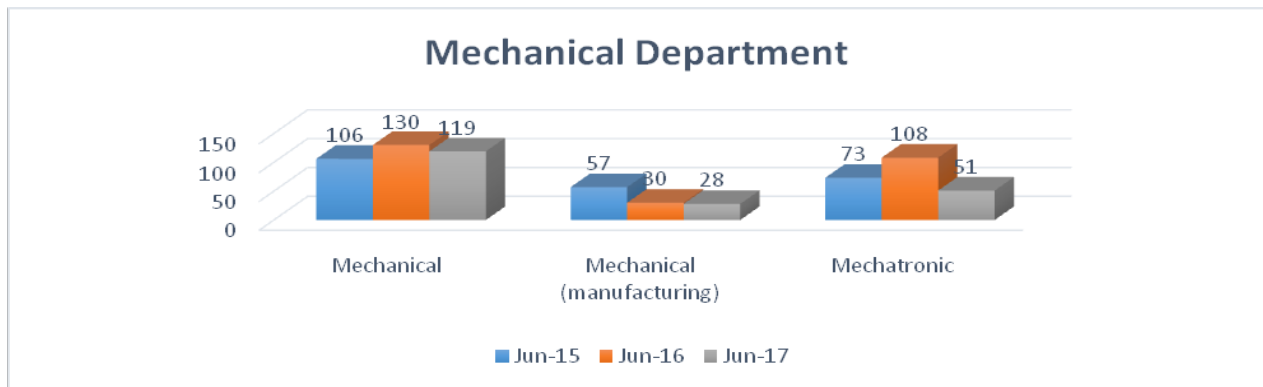


Figure 6: Enrollment (June Intake), Mechanical Engineering Department

Figure 7 indicates that enrollment for the Mechanical Engineering program increased by 22.64% between 2015 and 2016. However, this trend reversed in 2017, as enrollment decreased from 130 to 119—a drop of 8.46%. The same pattern occurred for the Mechatronic Program, for which enrollment increased by 47.49% between 2015 and 2016 but decrease by 52.77% between 2016 and 2017. There were different results for the Manufacturing Program, for which enrollment continued to decrease from 2015 through 2017: by 47.36% from 2015 to 2016 and by 6.67% from 2016 to 2017.

Why did the June enrollment figures decrease for each program offered by the Mechanical Engineering Department? The department's Manufacturing Program is worse off when students have less interest in taking such courses to advance their career paths. The same pattern also applies to the Mechatronic Program.

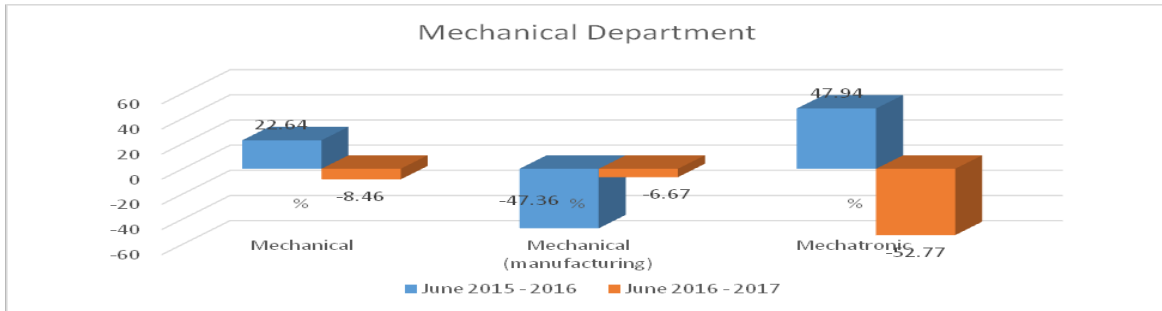


Figure 7: Changes in Enrollment (June Intake), Mechanical Engineering Department

Table 3 presents trends in enrollment for each program in the Mechanical Engineering Department from 2015 through 2017. The findings indicate that enrollment for the Mechanical Engineering Program increased by 20% between 2015 and 2016. However, this trend reversed in 2017, as enrollment decreased from 30 to 8—a drop of 73.33%. Furthermore, that department’s Manufacturing Program had contrasting results: between 2015 and 2016, enrollment increased by 85.71%, and between 2016 and 2017, it continued to increase—this time by 171.42%. The Mechatronic Program had decreased enrollment between 2015 and 2016 (from 13 to 9, a decrease of 30.77%). However, its enrollment increased by 333.33% from 2016 to 2017.

The enrollment for all mechanical engineering programs was lower in December than in June. This scenario may be due to students choosing to attend other technical institutions such as Institut Kemahiran Mara and Institut Latihan Perindustrian. The six-month gap between session is a long period for parents and students to wait, so choosing to attend another institution may be the best choice. Parents do not want their children to waste time with activities such as smoking, drugs and *rempit* as they wait to attend school. Another reason is the possibility that the students cannot fulfill requirements such as the need for mathematics credits.

Table 3: Enrollment (December Intake) – Mechanical Department

Session	Mechanical-			Total
	Mechanical	Manufacturing	Mechatronic	
December2015	25	1	13	39
December2016	30	7	9	46
December2017	8	19	39	66
Change: 2015–2016	+20.00%	+85.71%	–30.77%	
Change:2016–2017	–73.33%	+171.42%	+333.33%	

5.0 Conclusion

Semiskilled workers are very important links with developing the country throughout industries requirement. Without better semiskilled workers present in industrial may affect the strategic and planning links with government inspiration. TVET institutions such as Politeknik Malaysia teach students engineering knowledge and skills in order to provide industry with semiskilled workers.

This study investigates the patterns of engineering enrollment (especially for the Mechanical Engineering Department) at Politeknik Tuanku Sultanah Bahiyah. The enrollment for all engineering departments (civil, electrical and mechanical) decreased in 2017. This study's results show that enrollment in all the mechanical engineering programs decreased in both the June and December sessions—but especially so for December—from 2015 through 2017. Notably, enrollment for students seeking a mechatronic diploma decreased in 2017 by close to 50%.

This scenario occurs because many students cannot wait until the December session to enroll and because many parents send their children to other technical institutions such as Institute Kemahiran Mara and Institut Latihan Perindustrian. Parents do this in part to ensure that their children do not waste time with activities such as smoking, drugs and *rempit*. Another reason for this decline in December is the possibility that students cannot fulfill requirements such as the need for mathematics credits.

This study focuses only on engineering students in the Civil, Electrical and Mechanical Engineering Departments at Politeknik Tuanku Sultanah Bahiyah. The results were analyzed for engineering students only. This study did not consider non-engineering students such as those in commercial programs because the institution has different admission requirements for those programs. Further studies could be done to investigate the relationship between admission to engineering programs and employability.

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